5.0 Structural Pass/Fail Criteria

The primary load path should remain intact. Yielding for energy absorption is acceptable, and generally desirable. In this sense, yielding is a controlled, predictable deformation, where load carrying capability is maintained. Instability failures in primary load carrying members are not yielding and are not acceptable unless a secondary, predictable stable state is reached.

Some damage to the primary load path is expected and acceptable, however. Damage should be evaluated considering the role of the load carrying element in its critically loaded condition. Damage that might be unacceptable in a rear leg (tension) fitting might be acceptable in a forward leg (compression) fitting, depending on the consequence of the failure mode. Deformation to the extent that rapid egress is not compromised is encouraged. Minor cracking of primary structural elements and separations of some fasteners (a minority of fasteners in a row, for example), or minor delamination can be accepted if the remainder of the structural requirements have been satisfied. That is, the primary load path is intact, the seat remains attached at all points of attachment, and the occupant restraint system remains attached at all points of attachment. Hazardous projections or sharp edges shall not be created and egress shall not be compromised as discussed in current guidance.

For the restraint system, scuffing and fraying or breakage of some fibers is expected and should be acceptable. Tearing or cutting is indicative of a problem and is not a predictable mode of failure. Tears or cuts to the restraint system are not acceptable.

5.1 Test Failures vs. Retest

A variety of different failures can result in an unsuccessful test. Failures can range from structural separation of the seat from the tracks to deployment of items that constitute an impediment to egress. All such failures should be addressed and corrective action taken. However, the necessity to repeat tests following corrective action should be subject to the same sort of decision process that is used to determine which tests are conducted initially.

Failures in any part of the primary load path, including the seat attachment to the track or restraint system attachment to the seat will almost exclusively require retest. Failures in (secondary) internal structure may be able to be addressed analytically. For example, failures in members for which analytical substantiation is acceptable when making the test article selection (using the procedures outlined elsewhere in this concept paper), may not require retest. However, each case should be assessed individually, and a determination made that the failure point would not simply be transferred to another part of the load path. Generally speaking, members for which the failure mode is not catastrophic (e.g., compressive failures in a forward leg, as opposed to a tension failure in an aft leg for a 16g forward test), are less likely to warrant retest. The extent to which a secondary load path(s) can carry the load is a factor in determining the pass/fail of a structural test.

Special attention to the seat structure prior to the removal of floor warpage is advised. Structural failure can occur as a consequence of removal of floor warpage. If it can be determined that the damage or seat deformation occurred solely as a result of, or was caused solely by, removing the floor warpage, it shall not be considered a failure.

The evaluation of the seat attachment should be made before the seat tracks are straightened (unwarped). The process of straightening the seat tracks may result in a seat attachment becoming detached. This is not a failure of the test. The assessment for seat attachment should be made after the restraining force on the pitch-and-roll fixture has been released. It is not necessary to return the floor to a flat condition to evaluate the seat attachment. Once the evaluation for seat attachment has been completed, the floor may be returned to a flat state in order to take deformation measurements (if applicable).

Cuts or tears in a restraint system may not require a retest if it can be demonstrated that the corrective action will be effective, and if all other pass/fail criteria were met on the test in question.

Failures of attachments of items on the seat may be addressed analytically, provided that the corrective action does not impact the primary load path of the seat/occupant system or occupant injury criteria. However, the seat must be shown to be able to carry its full weight, including any attached items. Similarly, items that deploy should not require retests, if the corrective action does not affect the dynamic behavior of the seat or occupant.

In the case of a test that exceeds the minimum test conditions where the test results in a failure, an assessment of the test conditions and the failure mode must be made and a reason for retest without change must be presented to allow a retest without modification.